

Agroforestry and carbon sequestration

Reference 6

Bayala, J; Kalinganire, A; Sileshi, GW; Tondoh, JE. 2018 Soil Organic Carbon and Nitrogen in Agroforestry Systems in Sub-Saharan Africa. A Review. In: Improving the Profitability, Sustainability and Efficiency of Nutrients Through Site Specific Fertilizer Recommendations in West Africa Agro-Ecosystems pp. 51-61, Springer, Cham. doi: 10.1007/978-3-319-58789-9_4

Background and objective

Trees in farming systems play a range of ecological functions among which soil fertility improvement seems to be the most accepted role, particularly through the increase in soil carbon and nitrogen. This study aims at capitalizing the existing information about soil organic carbon and nitrogen improvement of four key agroforestry practices (alley cropping, improved fallow, mulching and parkland). Here, only results on soil organic carbon (SOC) were reported.

Search strategy and selection criteria

Literature search through ICRAF, FAO, and Google Scholar. The search equation included the terms Agroforestry, soil fertility, and the four types of systems considered. 1) The data are from sub-Saharan Africa; 2) The publication contains reported carbon and nitrogen data of the four agroforestry practices and a corresponding control plot where the practice was not applied, with mean values reported numerically; 3) Data were from well designed and replicated experiments or observational studies either on a research station or on farmers' fields.

Data and analysis

Data were converted to mean difference and were further analyzed using mixed models fitted using Restricted Maximum Likelihood (REML). 95% confidence intervals of mean differences were computed.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
34	Arable land in Sub-Saharan Africa.	Plots with one agroforestry practice among alley cropping, improved fallow, mulching and parkland.	Plots without alley cropping, improved fallow, mulching and parkland.	Difference of SOC between plots with and without one agroforestry practice.	50%

Results

- The four tested systems increased significantly soil organic carbon. The mean increase levels were of 20.6, 22.8, 39.5, and 35.5% for Alley cropping, Fallow, Mulching and Parkland, respectively.
- Alley cropping increased SOC by 20.57% (95 CI: 6.76–34.39). Improved fallows by 22.8 % (95 CI: 8.6-37.1). Mulching by 39.5% (95 CI: 20.7-82). Parkland by 35.5% (95 CI: 25.1-45.9).
- Differences in SOC between agroforestry and non-agroforestry plots seem to increase with increasing absolute SOC content in plots.
- NA
- NA

Factors influencing effect sizes

Level of increase of soil carbon depends on the type of agroforestry (alley cropping, improved fallow, mulching or parkland) and soil characteristics.

Conclusion

The results revealed an increase in soil organic carbon of different types of agroforestry systems, over their corresponding treeless control plots.